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BOTANY.—*Two new varieties of* Salix scouleriana *Barratt.*[1] CARLETON R. BALL, University of California.

The well marked but variable species complex known as *Salix scouleriana* is distributed from New Mexico and southern California to the Yukon Valley of Canada and Alaska. In altitude it ranges from sea level along the Pacific Coast, from California to Alaska, to elevations of 8000 or 9000 feet in the southern part of the Rocky Mountains and in the San Bernardino Mountains of California.

It has been described under several specific names, including *S. scouleriana* Barratt (1839), *S. flavescens* Nuttall (1841), *S. stagnalis* Nuttall (1841), *S. brachystachys* Bentham (1857) and *S. capreoides* Andersson (1858). Probably some of the plants so named represent distinguishable varieties, but none of them is so recognized as yet. This is due in part to the difficulties of current herbarium material. It is a species of extremely precocious flowering and the promptly deciduous aments fall before the leaves develop. Some plants flower in December on the Pacific Coast. Except in the rare cases where collections are made from the same plant at intervals of some weeks, therefore, it is almost impossible to know what observed leaf forms are associated with certain ament and flower characters. The species certainly would be better understood if it could be split into varieties. Happily it now is possible to segregate and describe two varieties hitherto unrecognized.

The writer desires to express thanks for the many courtesies received from the staff of the Department of Botany, University of California.

SALIX SCOULERIANA var. **coetanea** Ball, var. nov.

Sectio Capreae. A specie typica amentis coetaneis, pistilliferis iis speciei aliquando laxioribus, et ambobus in pedunculis brevibus folioso-bracteatis fultis differt.

[1] Received October 17, 1933.

Shrub usually 2–4 or rarely 5 m. high. Branchlets rather slender, fragile (or readily deciduous in drying), divaricate, the 2-year brown to dark brown and glabrate to glabrous, the 1-year and seasonal shoots yellowish to brown and usually finely and often sparsely puberulent. Bud scales small, colored and clothed as the branchlets. Stipules wanting, or rarely 2–5 mm. long on vigorous shoots, broadly lanceolate, dentate, puberulent. Blades oblanceolate and acutish to obovate and obtuse or rounded at apex, cuneate at base, 3 to 5 cm. long by 1.5–2.5 cm. wide, or the larger up to 6 by 3 cm., entire and slightly revolute on the margins or the distal on seasonal shoots irregularly crenulate-denticulate, dark green above, glaucescent to glaucous beneath, puberulent on both surfaces (probably becoming glabrate in age).

Aments coetaneous, borne on short, leafy-bracted peduncles, the staminate peduncle about 5 mm. long, with small bracts, the pistillate peduncle 5–15 mm. long and bearing 3–5 small leaf-like bracts, 0.5–2 cm. long. Staminate aments 1–2 cm. long, Pistillate aments 1.5–4 cm. or sometimes 5 cm. long; pedicels of the capsules 0.5–1 or 1.5 mm. long; styles short, stigmas elongated, 1 mm. long, usually entire. Flower scales in both sexes elliptical-obovate, acutish to rounded, black, longvillous.

This is a shrub with the general characters of *S. scouleriana*, but differing from type concept of that species and the next variety in having the aments coetaneous, the pistillate rather lax, and both sexes borne on short, leafy-bracted peduncles. For the material on which the description is based, botanists are indebted chiefly to two very discriminating collectors, Joseph P. Tracy of Eureka, California, and J. William Thompson of Seattle, Washington. The writer is glad to acknowledge his personal obligation to both.

As will be noted from the specimens cited, variety *coetanea* flowers from May to June, and fruit may be found during June and early July, in marked contrast to the early spring flowering of the species. Even at sea level, flowering did not occur until mid-March. There must be admitted the possibility that this condition results from physiological disturbance of the plant. The increasing number of collections, over a wide area, however, make this unlikely. The type specimen (pistillate) is Thompson No. 9297 in herbarium C. R. Ball (2 sheets).

So far as available material indicates, this variety is confined to the central part of the range of the species. It occurs sparingly from northwestern California to Nevada and Utah, and north to south-central Washington, western Montana, and the mountains in the southern parts of Alberta and British Columbia. It is found, therefore, in the Wasatch, Rocky, Sierra-Cascade, and Coast Range mountain systems. Except for the one collection near the ocean, where precipitation and fog maintain low temperatures, the collections are all from elevations of 4000 to 6000 feet. It seems probable that the variety will be found to have an even wider range.

Specimens examined are cited below. The containing herbariums are: CRB, Carleton R. Ball; NMC, National Museum of Canada; PC, Pomona College; UMont. University of Montana; and UC, University of California.

CALIFORNIA: Humboldt Co. Ferndale, alt. 100 ft., shoots from cut and

burned stump, *Joseph P. Tracy* 10921, (UC). Trinity Summit, shrub 10 ft. tall, on dryish slopes back from the meadows, Corral Prairie, alt. 5000 ft., *Joseph P. Tracy* 10507, (CRB, UC); shrub with erect branches, 15 ft. tall, at edge of meadow, same locality, *Tracy* 10518 (UC). Trinity Summit, common shrub in moist places, 6–10 ft. tall, rocky, exposed places, head of Devil's Hole, alt. 6000 ft., *Tracy* 10694, (CRB, UC). Trinity Summit, rocky exposed places, head of Brett Hole, alt. 6000 ft., *Tracy* 10714, (UC). Modoc Co. In lodgepole pine woods, north slope of Bidwell Mtn., Warner Mts., *Elmer I. Applegate* 7619, (CRB).

NEVADA: Head of Fall Creek, Ormsby Co., elev. 2460 m., *C. F. Baker* 1153, (PC; distrib. unnamed; ♀ and ♂, the latter aments 1 cm. long, the peduncles 0.5 cm. and bracted). Lake Tahoe, Nevada, *M. E. Jones*, (PC, distrib. unnamed; fruit past ripe).

MONTANA: Missoula, on trail to Mt. Stuart, alt. 6000 ft., *J. E. Kirkwood* 1076, (UMont, UC).

WASHINGTON: Kittitas Co. Upper alpine slopes of Redtop, alt. 4500 ft., *J. Wm. Thompson* 9297, (CRB, UC, luxuriant growth, leaves green beneath from artificial drying); same locality, alt. 4000 ft., *Thompson* 9303, (CRB, UC; "more robust than 9297, and occupying a definitely lower zone"). Chelan Co. Blewett Pass, Wenatchee Mts., abundant in thin timber on open hillsides, elev. about 4200 ft., *C. R. Quick*, 1057, (♀, ♂), (CRB, UC).

UTAH: La Sal Mts., *M. E. Jones*, (PC). City Creek Canon (Ogden?), *M. E. Jones* (PC).

BRITISH COLUMBIA: International Boundary Commission. Near International Boundary between Midway and Osoyoos, first summit west of Skagit River, *J. M. Macoun* 73683 (NMC). Mons, Pacific Great Eastern Ry., *J. M. Macoun* 97789, 97790 (NMC).

ALBERTA. Banff and vicinity, *N. B. Sanson*, 19, 145, 161 (CRB).

SALIX SCOULERIANA var. **thompsoni** Ball, var. nov.

Salix brachystachys Bentham, *S. scouleriana tenuijulis* Andersson (in part) Monog. Sal. Kon. Svensk. Vet.-Akad. Handlingar **6**: 83. 1867.

S. brachystachys, β *scouleriana*, 1. *tenuijulis* Andersson (in part). DC. Prodr. 16(2): 225. 1858.

Sectio Capreae. A forma typica differt ramulis gracilioribus, strictioribus, et glabrescentioribus, foliis minoribus plerumque anguste ellipticis vel anguste oblanceolatis, 3–7 cm. longis, 1–2 cm. latis, plerumque plus minusve crenato-denticulatis, et amentis minoribus gracilioribus, 1–2.5 cm. longis.

Differs from the species in the slender, elongated, more glabrate branchlets, the small and slender aments, and the small, mostly narrowly oblanceolate, and usually more or less crenate-denticulate leaves.

Shrub 2–4 or sometimes 6 m. high, branchlets usually slender, elongated, straightish, ascending, and tough; 1-year and 2-year branchlets usually black or dark brown, glabrous and often shining; seasonal shoots pubescent or puberulent, becoming glabrate; bud scales 4–7 mm. long, colored and clothed as the shoots bearing them; stipules usually wanting, or 1–2 mm. long and semi-cordate on vigorous shoots; petioles 5–10 mm. long, pubescent to glabrous; leaf-blades relatively small, those on seasonal shoots and the upper leaves on 1-year and 2-year branchlets narrowly elliptical to oblanceolate, commonly 1 by 3, 1.2–1.5 by 4, 1.5–1.8 by 5–6, and 2.5 by 7.5 cm. in

size; the lowermost on these branchlets broadly oblanceolate, commonly 1.5 by 3–3.5 and 2 by 4 cm. in size; all usually cuneate at base; narrower blades acute or short-acuminate, lower and broader often obtuse; the upper narrower irregularly and often prominently crenate-denticulate, the lower entire or subentire; all green and glabrous above or the younger puberulent,

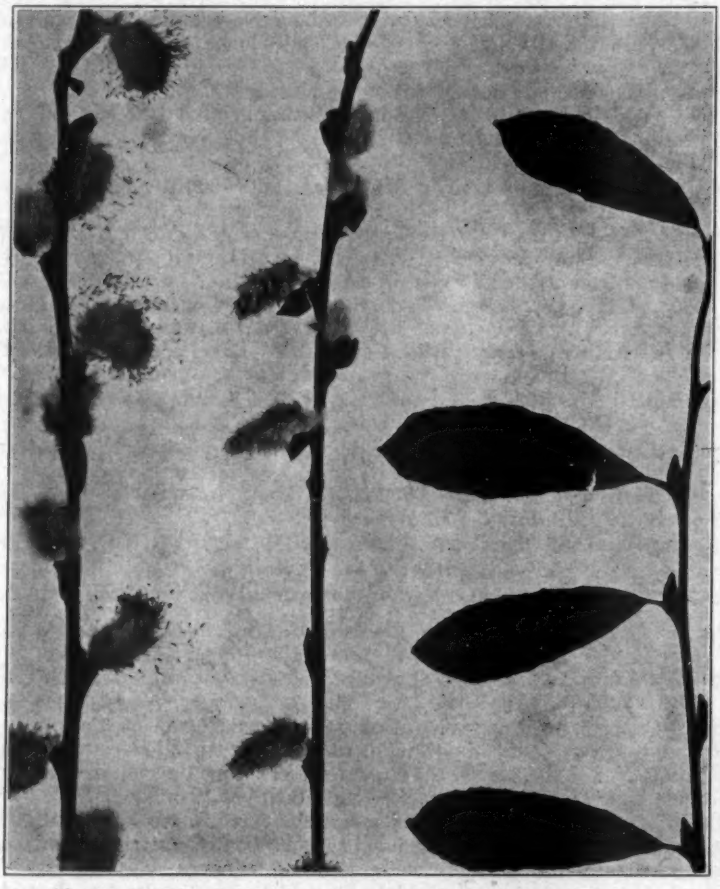

Fig. 1.—*Salix scouleriana* var. *thompsoni* Ball. Portion of pistillate and staminate cotype specimens.

all pale green to subglaucous beneath, the older glabrous to glabrate, younger pubescent or occasionally tomentose beneath with gray hairs which often become somewhat rusty in color.

Staminate aments 1–2 cm. long, almost sessile; stamens two, filaments free, glabrous; scales usually somewhat narrower than those of the pistillate flower. Pistillate aments 2–3 cm., or occasionally 4 cm. long at maturity, usually slender and incurved, on tomentose peduncles 5–7 mm. long and

bearing 2–3 pilose bracts or small, bract-like leaves; capsule lance-rostrate, 6–7 mm. long, gray-pubescent, borne on a pubescent pedicel 1–1.5 mm. long; style very short, 0.2–0.5 mm. long; stigmas entire or divided, 0.5–1 mm. long; scales broadly oblanceolate or obovate, 1.5–2.5 mm. long, acute to obtuse or sometimes slightly erose at apex, black, densely pilose on outside and thinly pilose inside with long, shining hairs.

The existence of the well marked variation described above has been known for several years but publication has been delayed until the collection of flowers and foliage from the same plants should make possible a complete and accurate description. This convincing material has now been made available by Mr. J. William Thompson, of Seattle, whose critical collections are adding rapidly to the known flora of this large and diverse State. It is a real pleasure to name this variety in his honor.

The portion of the *scouleriana* complex to which variety *thompsoni* is most closely related is the variety or form *tenuijulis* described by Andersson, as cited at the opening of this discussion. From Andersson's form it differs in still smaller aments and foliage and especially in elliptical or elliptical-oblanceolate and denticulate leaves, as well as in much less pubescence on branchlets and leaves.

The center of distribution for this variety appears to be the Puget Sound area of Washington and the Georgian Bay area of adjacent British Columbia. It has been found by Pammel on the Oregon Coast below the mouth of the Columbia River. Away from the coast it has been taken at appreciable elevations in the Cascade Mountains, at Easton, Washington, by Pammel and on Mt. Benson, Vancouver Island, by John Macoun. Doubtless the known range will be extended still further when these facts come to the attention of collectors.

The initials of the herbariums containing the specimens cited below are: CRB, Carleton R. Ball; NMC, National Museum of Canada; UC, University of California; and USN, United States National Herbarium. The following specimens have been examined:

OREGON: Clatsop Co. Gearhart Park, *L. H. Pammel* 13, (CRB).

WASHINGTON: King Co. Seattle: *Piper and Smith* 556 (in part), (CRB); *C. V. Piper*, March, 1890 (CRB); about 3 miles north of city limits, *C. V. Piper* 6682, 6686, 6693, (CRB); moist slopes along Cheasty Boulevard, *J. William Thompson* 5896 (pistillate type collection), 5898, 5900 (staminate type collection), 5901, (CRB). Pierce Co. Tacoma, shrub, 10–20 ft. high, common in gravelly soil, *J. B. Flett* 1884, March 6, April 14, and June 14, 1901 (CRB); abundant in vacant lots, dry places, *J. B. Flett* 2272, 2272a, (CRB); *L. H. Pammel* 34, (CRB). Kittitas Co. *Easton, Pammel and Dudgeon* 19, (CRB). Snohomish Co. Marysville, *J. M. Grant* 208, 209, 211, (CRB); 203, (CRB, UC, *sub nomen S. caudata*). San Juan Co. Lopez Island, shrubs 6–9 feet high, dry roadsides near the "Holy Roller" colony, Hunter's Bay, *C. R. Ball* 2084, (CRB).

BRITISH COLUMBIA: Vancouver Island. Cowichan Lake, *W. Spreadborough* 83853, (NMC). Departure Bay, *W. Spreadborough* 2, (NMC, 83847 and

83857); 3, (NMC, 83846 and 83854); 4, (NMC, 83845 and 83848); 5, (NMC, 83844 and 83849); 6, (NMC, 83843). Mt. Benson, upper slopes, alt. 3200 ft., *John Macoun* 76800, (CRB, NMC). Nanaimo and vicinity, *John Macoun* 76802, (CRB, NMC); in thickets, *John Macoun* 80958, (NMC); *John Macoun* 76804, (NMC); *W. Spreadborough* 15, (NMC 83850). Strathcona Park, Drumm Lake, *J. M. Macoun* 83881, (NMC). Victoria and vicinity, *John Macoun* 76770, (CRB, NMC); in thickets, Burnside Road, *John Macoun* 76766, (NMC); Beaver Lake, *John Macoun* 76801, distributed as *S. geyeriana* (CRB, NMC, branchlets very short, crowded); *A. J. Pinio* 68682, (NMC); *M. O. Malte* 122135, (NMC, UC). Georgian Bay Islands. Mayne Island, *J. M. Macoun* 90155, (NMC). Salt Spring Island, wet places, *John Macoun* 24470, (NMC, UC). New Westminster District. Ocean Park, 3 miles north of 49th parallel, gravelly hillsides on logged and burned land, *J. K. Henry* 6, (CRB, 3 sheets; NMC, 2 sheets); *Henry* 7, (CRB, 3 sheets; NMC, 2 sheets); *Henry* 12, (CRB, NMC). All distributed unidentified, NMC Nos. 117206–117209, and 117211. Powell River, erect bushes, 8–10 ft. high, *J. G. Jack* 2838, (CRB).

ZOOLOGY.—*Two new species of pearly fresh-water mussels.*[1] WILLIAM B. MARSHALL, U. S. National Museum. (Communicated by PAUL BARTSCH.)

The recent pearly fresh-water mussel described herein comes from southern Paraguay and belongs in the genus *Anodontites*. The fossil species comes from the State of Monagas, Venezuela, and is the type of a new genus, *Castalioides*.

Castalioides, new genus

Shell with strong sculpture of radial ribs, several of the innermost pairs arranged to form very long V's. Ribs crossing the anterior and posterior slopes form a divaricate pattern with the radial ribs.

Type: *Castalioides laddi* described below.

Castalioides laddi, new species

Shell subelliptical, slightly inflated. Beaks set well forward (at about the first one-quarter of the length). Dorsal margin arcuate; anterior margin rounded and rounding into the ventral margin which is slightly arcuate and joins the posterior margin in a sharp curve. Posterior end obliquely subtruncate. Anterior ridge not differentiated from the general surface except by the divaricating sculpture along it. Posterior ridge high, subangular. Posterior dorsal area rather broad. Sculpture of strong, nearly straight, radial ribs, several of the innermost pairs joining to form very elongate V's with the apex pointing toward the ventral margin. Distant from the beaks the ribs become somewhat irregular. Several low ribs originating on the posterior

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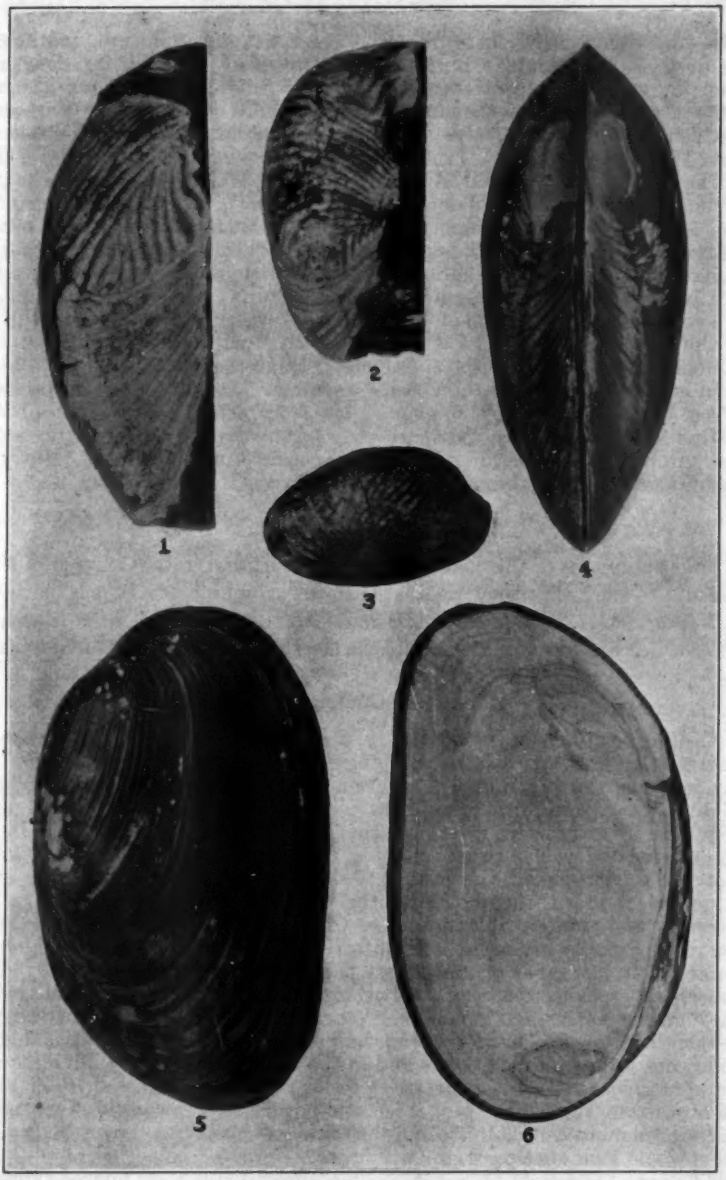

Figures 1–6.

Figs. 1–3. *Castalioides laddi*. Fig. 1.—Posterior sculpture of type ×2. Fig. 2.—Anterior sculpture of type ×2. Fig. 3.—Right valve. Natural size.
Figs. 4–6. *Anodontiles schadei*, type specimen. Natural size.

ridge and divaricating there from the general radial sculpture, run across the posterior area. Similar, but smaller, more sharply defined ribs divaricate from the general sculpture near the anterior ridge and run across the anterior area. (Teeth not showing in the type, but judging from imperfect teeth showing in a right valve paratype, they resemble those of *Tetraplodon linki* Marshall.)

The type, U. S. National Museum (Cat. No. 373033) measures: Length, 40 mm.; height, 22 mm.; diameter (about 24 mm.). It and a paratype (Cat. No. 373034) were found fossil near Aragua de Maturin, capital city of the District of Piar, State of Monagas, Venezuela. This locality is on the Aragua River, a tributary of the Guarapiche River, which in turn is tributary to the San Juan whose waters drain into the Gulf of Paria, formed by the mainland of Venezuela and the Island of Trinidad. Two other paratypes were returned to the Venezuela Gulf Oil Co. from which the material was received. The geological age quoted for the specimens is Quaternary.

In general appearance the species resembles *Tetraplodon linki* Marshall[2] (Proc. U. S. Nat. Mus. 69: 6, *plate 1, figs. 6, 7; plate 3, fig. 2.* 1926), but is distinguished generically and specifically by the divaricated sculpture along the anterior and posterior ridges. The species is named for Dr. Harry S. Ladd, through whose kind efforts the material was obtained.

Anodontites

Four specimens of this genus, all in bad condition, retain enough of their features to show that they are related to the group including such species as *A. tortila* Lea, *A. lacteola* Lea, *A. palmeri* Marshall and *A. pittieri* Marshall, all of which are recent species from the northern coast of South America.

Anodontites schadei, new species

Shell of medium size, rather heavy, oblong; dorsal margin lightly arched; ventral margin nearly straight, sloping upward at the anterior end and fading into the sharply rounded anterior margin; posterior margin oblique, slightly arched and forming with the ventral margin a widely rounded point which points downward, giving the shell a rather oblique appearance. Beaks eroded, located well forward, making the shell appear to hunch forward. Anterior ridge rounded, the descent to the anterior margin abrupt. Posterior ridge low, rounded, the descent to the posterior and dorsal margins rather steep. A well-marked riblet traverses the posterior area from the beaks to the rear extremity of the shell. Sculpture consisting of fine concentric growth striae, with a number of major rest periods prominently marked by deep concentric grooves. Centre of shell nearly smooth, posterior area and around the margins somewhat lamellate. Color chestnut, dark greenish near the beaks, the colors darker on the front half of the shell. Interior whitish, highly iridescent in the adductor scars and in the area between the pallial line and the margins. Anterior scar deep, posterior scar well-impressed. Pallial line 15 mm. from ventral margin. Prismatic border dark greenish olive, rather wide throughout but widest along the middle of the ventral margin. Sinulus narrow and long, its tip curving backward.

The type (U.S.N.M. No. 434732) measures: Length, 90 mm.; height, 53

[2] Von Martens in letter to Pilsbry (Princeton University Expeditions to Patagonia, 1896–99, 3: 610. 1911) says the generic name *Tetraplodon* is a synonym of *Castalia*.

mm.; diameter, 34 mm. It and a paratype (No. 424837) come from the Tubicuary River at Aroja in southern Paraguay, and were collected by Mr. F. Schade for whom the species is named and were presented by Mr. Hugh Fulton of London. The Tubicuary River is a tributary of the Paraguay about 65 miles above its confluence with the Parana and hence is in the La Plata system.

The nearest relative of *Anodontites schadei* is *A. mansfieldi* Marshall of the Rio Yaguaron and its branches, in Cerro Largo, Uruguay. *A. mansfieldi* is lighter in weight, proportionally more elongate, has the sinulus broad and curving forward, the interior typically rosy, the posterior end well-elevated above the ventral margin, and the prismatic border much wider, approaching in character the very wide prismatic border of *Anodontites patagonica* Lam. In addition to these differences, the two species come from different drainage systems.

ZOOLOGY.—*A new genus of Trematodes belonging to the subfamily Allocreadiinae.*[1] EDWIN LINTON, University of Pennsylvania. (Communicated by PAUL BARTSCH.)

In the manuscript of a paper: *Some Trematodes of fishes, mainly from the Woods Hole region*, awaiting publication, a new generic name is proposed to accommodate distomes, recorded in earlier papers by the author under the name *Distomum vitellosum*. To avoid possible confusion in nomenclature it has been suggested that a brief description of the new genus be published.

Cymbephallus Linton, gen. nov.

Body smooth, moderately elongate; ventral sucker surrounded by a raised border of the body wall, which may be more or less scalloped, papillate, or slightly fimbriate; cirrus very short, appearing as a muscular sucker at the orifice of the ejaculatory duct in front of the ventral sucker, to the left of the median line. Testes smooth or lobed, median, one following the other, behind the smooth or lobed ovary. Vitellaria diffuse.

Type species, *Cymbephallus vitellosus* (Linton).

CYMBEPHALLUS VITELLOSUS (Linton).

Distomum vitellosum Linton. Bull. U. S. Fish Com. 1899: 290, 416, *fig. 38, 39*, and *333–340*. Bull. U. S. Fish Com. 1904: 335. Proc. Nat. Mus. **33**: 105.

These distomes assume a great variety of contraction shapes. Living examples are usually relatively short with breadth one-third or more of the length. When placed in fresh water or weak formalin they tend to become turgid and may elongate until the length is six or more times the breadth. Under pressure the living worm may become several times as long as broad. Neck short, conical, often reflected dorsad, especially in turgid specimens;

[1] Received October 18, 1933.

posterior end of body frequently tapering to a blunt point. Ventral sucker larger than oral, ratio about 8:5, surrounded by a raised border, which may appear to be sinuous in outline, or to bear 4 or 5 lobes on the posterior border and about 4 on the anterior border, often inconspicuous in mounted specimens. In turgid specimens the ventral sucker is prominent, often more or less pedicellate. Maximum length in balsam about 3.5 mm. Pharynx usually a little longer than broad, ratio of length of pharynx to diameter of oral sucker about 4:5. Prepharynx very short or none; esophagus as long or longer than pharynx; intestinal rami reach nearly to the posterior end of the body, usually hidden by the dense vitellaria. Genital pore in front of the ventral sucker to the left of the median line; the ejaculatory duct terminates in what has the appearance of a strong, muscular sucker-like structure, at the anterior border of which is the opening of the metraterm. The seminal vesicle extends one-third or more of the distance between the ventral sucker and the ovary. The two testes, the one following the other, lie about midway between the ventral sucker and the posterior end. They are usually circular or oval in outline, occasionally subtriangular and rarely slightly lobed. Ovary near anterior edge of first testis usually more or less elliptical in outline. Vitellaria diffuse, continuing from near posterior edge of ventral sucker to the posterior end of the body, often obscuring the other organs. Uterus between ovary and ventral sucker. Ova, average of 24 specimens from 16 different specific hosts, in balsam, 0.053 by 0.029 mm.; maximum 0.063 by 0.033, minimum 0.045 by 0.027.

Recorded from 34 species of Woods Hole fishes, from 15 species of Beaufort fishes and from 5 species of Bermuda fishes. Found in the intestines.

Cymbephallus fimbriatus Linton, sp. nov.

Distomum vitellosum Linton, Bull. U. S. Fish Com. 1899: 462. Bull. U. S. Fish Com. 1904: 388, 390, 399, *fig. 176–178.*

Body elongate, not varying much in diameter; neck short, more or less conical; ventral sucker larger than oral, prominent, sometimes pedicellate, surrounded by a border of short papillae; pharynx elliptical-ovate, longer than broad; esophagus longer than pharynx; intestinal rami extend to posterior end; genital pore in front of ventral sucker, on left of median line, the opening of the ejaculatory duct a strong, muscular sucker; opening of the metraterm with sphincter on blunt papilla at anterior border of genital sucker; seminal vesicle elongate, curved, extending from one-third to more than one-half the distance between the ventral sucker and the ovary; testes two, the one following the other with but a short interval between, in some cases lobed, in others lobes not distinct; ovary at or near the anterior edge of the first testis, usually not lobed, although a tendency to lobing was observed in a few cases. Vitellaria diffuse, filling the body back of the testes, and extending to a point about half way between the ovary and the ventral sucker. Ova about 0.06 by 0.03 mm. Maximum length, in balsam about 5 mm.

From *Menticirrhus saxatilis*, Woods Hole; from *Bairdiella chrysura*, *Menticirrhus americanus* and *Sciurus ocellatus*, Beaufort. Found in the intestines.

This species differs from *C. vitellosus* in its larger size, and in having longer and more numerous papillae bordering the ventral sucker, in the lobed

character of the testes and larger ova, also in that the seminal vesicle extends farther back of the ventral sucker, and the vitellaria do not reach to a point as near the ventral sucker. Furthermore while *C. vitellosus* tends to taper towards the posterior end, *C. fimbriatus*, as a rule, maintains its breadth back of the ventral sucker and is bluntly rounded at the posterior end. There are, however, many contraction shapes in both species which make it difficult to fit descriptions to them.

ORNITHOLOGY.—*Bird bones from Eskimo ruins on St. Lawrence Island, Bering Sea.*[1] HERBERT FRIEDMANN, U. S. National Museum.

During several seasons of excavating ancient and more modern Eskimo habitations on St. Lawrence Island, Mr. H. B. Collins, Jr., Assistant Curator of Ethnology, United States National Museum, amassed a large collection of avian bones. Inasmuch as all his material was carefully collected with full stratigraphical data, it is possible to determine, in a relative sense, the different ages of the various specimens. Furthermore, since the time limits range from village sites abandoned half a century ago to some probably 2500 or more years old, the ages of the diggings vary appreciably. Of course, while 2500 years means a great deal in human cultural biology, it is of little moment as far as birds are concerned. The collection totals several thousand bones, all of which have been carefully studied and identified and are reported on in this paper. The bones are referable to 45 species of which 10 are new to the known avifauna of St. Lawrence Island. These 10 are as follows:

PUFFINUS TENUIROSTRIS	Slender-billed Shearwater
BRANTA CANADENSIS MINIMA	Cackling Goose
BRANTA NIGRICANS	Black Brant
MELANITTA DEGLANDI	White-winged Scoter
MELANITTA PERSPICILLATA	Surf Scoter
MERGUS MERGANSER subsp.	Merganser
HETEROSCELUS INCANUS	Wandering Tattler
LARUS CANUS BRACHYRHYNCHUS	Short-billed Gull
RISSA BREVIROSTRIS	Red-legged Kittiwake
BRACHYRHAMPHUS BREVIROSTRIS	Kittlitz's Murrelet

In addition to these, several species previously recorded on the basis

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of observational records alone, are represented in the present collection.

These bones, together with the collection of birds reported on in a previous paper (Proc. U. S. Nat. Mus., **80**, art. 12: 1–31. 1932.) give a fairly comprehensive picture of the avifauna of the island. Perhaps the most striking single feature is the complete absence of any species of ptarmigan, although both the Alaskan and the Siberian mainlands and most of the islands between them are inhabited by one or more forms of these birds.

In attempting to analyze the data from the viewpoint of ornithology, rather than ethnology or anthropology, we must remember that the number of bones of a given species is not a reliable index to the abundance of that species with respect to another, less abundantly represented, as the factor of human selection plays a large rôle. Thus, there are no raven bones in the present collection, but this does not mean that there were no ravens on the island at the time when the old villages were flourishing; it only means that Eskimos did not look upon ravens as food and did not kill them and leave their bones in and around their huts. On the other hand, it is obviously unlikely that the Eskimos would have been able to get numbers of birds of species that were rare at the time, so an abundance of remains does indicate a high numerical status for the species. It is the relative abundance of species that is chiefly affected by the element of selection. (By selection is meant not only the volitional choice of the Eskimo, but also his ability to procure the bird in question. Thus, a strong flying species that feeds over the open ocean, and relatively seldom roosts on the cliffs on the island would be very difficult to get and so, while desired by the Eskimo, might be "selected out" by his inability to get it.) Also some selection was involved in the actual collecting of the specimens.

The species most abundantly represented in the collection is Pallas's murre. It is obviously the most important single bird species to the Eskimo, and it is obvious from the enormous number of bones, that the species was as abundant in the past as it is in the present.

The other birds commonly used for food include the crested and the paroquet auklets, the Pacific and king eiders, and, strangely enough, the pelagic cormorant. One of the surprises was the paucity of goose bones, especially of the emperor goose. Pigeon guillemot, old-squaw, long-tailed jaeger, red-faced cormorant, and short-tailed albatross come next in descending order of frequency, and after them come a large number of species, present in varying quantities.

The village sites involved in this study have been described by Collins (Geogr. Review 22: 109–114. 1932.) from whose account the following remarks are extracted.

On the gravel spit near the present village of Gambell, at the northwest end of the island, are three abandoned villages, known to the Eskimos as Miyowaghameet, Ievoghiyogameet, and Seklowaghyaget, while a recently abandoned village immediately adjoins the present settlement of Gambell. The gravel spit extends westward from Gambell Mountain, on the slopes of which is the oldest village site, the one referred to in this paper as Hillside Village.

At the opposite, southeast, end of the island is the old village site of Kialegak, judged to be of approximately the same age as Ievoghiyogameet. The estimate of the age of the sites is, of course, very vague but in the case of the four villages near Gambell, it was possible for Collins to work out a relative, chronological sequence, even if the absolute age was indeterminable. To quote him on this point:

> Beginning at the base of the mountain and extending westward to the village at the end of the spit is a series of parallel ridges of gravel—old beach lines—which from the top of the mountain can be seen very distinctly. The position of the several old villages in relation to these former beach lines and to the present beach affords some evidence of their respective antiquity, for villages of the maritime Eskimo are always situated close by the sea or other body of water. The ruins closest to the present village at the end of the spit should be the latest; these are the recently abandoned houses . . . and the adjoining old site Seklowaghyaget. . . . In the same way the oldest of the abandoned villages should be Miyowaghameet . . . three-fourths of a mile away at the base of the mountain and half a mile distant from the sea and enclosed in the first two (the oldest) beach lines. Ievoghiyogameet . . . , some 200 yards north . . . (of Miyowaghameet), is separated from it by four beach lines and thus should date from a somewhat later period. Between . . . (it) . . . and the north shore are six more old beach lines, most of which were no doubt piled up after the abandonment of the village.
>
> The archeological evidence resulting from four months of intensive excavation bore out this assumed sequence. . . . A fifth site . . . (Hillside Village) . . . , unknown to the Eskimos and completely covered over with sod, moss, and rocks, was found on the lower slope of the mountain. . . .

To sum up for our immediate purposes, the oldest site is Hillside Village, estimated as possibly 2500 or more years old; next is Miyowaghameet, assumed to be about 2000 years old; then Ievoghiyogameet, around 1000 years old; Kialegak corresponds in age with Miyowaghameet and Ievoghiyogameet, chiefly with the latter; Seklowaghyaget is estimated to have been occupied up to about 200 years ago, and the recent Gambell site is supposed (on hearsay evidence from the natives, as well as from the nature of the excavated materi-

als) to have been abandoned about 40 years ago. The lower strata of its middens may be 100 years older.

In the course of his work Collins made a great many cuttings or diggings in each of these sites and recorded the levels of each. Of these individual diggings about 75 revealed bird bones. The time element in each site between superficial and basal strata is, however, too short to be of significance as far as the ornithological results are concerned, however much it may mean to the anthropologist, and in this paper I have combined many of these individual data.

I am greatly indebted to Mr. Collins for much information regarding the location and relative age of the sites, and for his patience in answering many questions more or less relevant to the immediate topic at hand.

The specimens of bones are all in the United States National Museum.

Family GAVIIDAE Loons

GAVIA ADAMSI (Gray) Yellow-billed Loon

The yellow-billed loon is represented only in the diggings of sites about 1000–2000 years old; thus the northern and western sections of Miyowaghameet yielded a fragmentary sternum, radius, and metacarpal; Ievoghiyogameet a fragmentary sternum; while the Kialegak site at the opposite end of the island produced a tarsometatarsus and a metacarpal of this bird.

Judging by the size of the bones of this species, which would make for both their preservation and discovery, the few bones found and the few diggings containing them seem to indicate that either the bird was always scarce or hard to get or not sought after by the Eskimos.

GAVIA ARCTICA PACIFICA (Lawrence) Pacific Loon

The Pacific loon appears first in the Ievoghiyogameet site where it is represented by a broken sternum. The Kialegak ruins yielded a single tibiotarsus attributable to this species. In the recent site at Gambell a part of a skull and a broken sternum were found. All in all, the story is similar to that of the yellow-billed loon, a scarcity of remains of the species due to the same several possible factors.

GAVIA STELLATA (Pontoppidan) Red-throated Loon

The diggings at Ievoghiyogameet and at Miyowaghameet, disclosed several bones of the red-throated loon. Ievoghiyogameet revealed this species in three separate cuttings representing the whole

time duration of the village deposit, from the surface layer to the basal portion, the bones (single ones in all cases) being a sternum, a tibiotarsus, and a metacarpal. At Miyowaghameet, in the relatively younger northwest deposits an ulna was found. In the much more recent deposits at Seklowaghyaget a tibiotarsus was unearthed.

Family DIOMEDEIDAE Albatrosses

DIOMEDEA ALBATRUS Pallas Short-tailed Albatross

In my paper on the birds of St. Lawrence Island (Proc. U. S. Nat. Mus., **80**, art. 12: 8. 1932.) I wrote that although Nelson and Turner saw this albatross at sea near and about St. Lawrence Island, the only definite records for the island are two mandibles found there by Nelson and a maxilla dug up by Collins at Miyowaghameet. A study of the present collection of bones has revealed this species in no less than ten separate cuttings ranging from the most recent sites to the most ancient one—the extent of time between the two extremes being around 2500 years or more. Beginning with the oldest, we may mention them in chronological sequence: Hillside Village, fragments of humeri, ulnae, and metacarpals; Miyowaghameet, 4 separate diggings, a total of one pair of maxillae, 1 pair of clavicles, 1 fragmentary ulna, 1 fragment of a mandible, 1 tarsometatarsus; Ievoghiyogameet, 2 cuttings, 1 fragmentary pair of clavicles, 1 tarsometatarsus, 3 metacarpals; Seklowaghyaget, 1 tibiotarsus; Gambell (recent) 2 cuttings, 1 humerus, 1 pair maxillae, 1 ulna, 1 radius.

Apparently the short-tailed albatross was used for food whenever it could be obtained. The large size of its bones makes it probable that relatively fewer were overlooked by the collector than in the case of smaller bird bones.

Family PROCELLARIIDAE Shearwaters, Fulmars

PUFFINUS TENUIROSTRIS (Temminck) Slender-billed Shearwater

This species has not been recorded previously from St. Lawrence Island. It is represented by a coracoid in perfect condition, found at Miyowaghameet.

FULMARUS GLACIALIS RODGERSI Cassin Rodger's Fulmar

Bones of this fulmar are noticeably scarce in the present collection, only two being definitely attributable to the species. At Ievoghiyogameet a coracoid was unearthed, and at Kialegak a tibiotarsus was

found. The fulmars, being very pelagic in their habits are probably seldom killed by the Eskimos, a fact that may help to explain the absence of further osseous remains.

Family PHALACROCORACIDAE Cormorants

PHALACROCORAX PELAGICUS PELAGICUS Pallas Pelagic Cormorant

The pelagic cormorant is represented in 17 individual diggings, from the most ancient to the most recent. It was most abundantly found in the deposits at Kialegak, where it was unearthed in 6 separate cuttings, and at Ievoghiyogameet, where it was revealed in five cuttings; 2 diggings at Miyowaghameet turned up bones of this cormorant as did also 2 cuttings at Seklowaghyaget; the ancient hillside village near Gambell and the recent village at Gambell each revealed one bone of this bird. Although in most of the 17 diggings only single bones or only a very few were found, in the upper layers at Ievoghiyogameet no less than 16 tarsometatarsi were unearthed. This extraordinary abundance makes one wonder what unusual conditions may have made the birds so accessible or sought after at that time.

It is noteworthy that although many limb bones were found, only 4 synsacra and 1 sternum were unearthed, and no parts of the skull or mandibles.

PHALACROCORAX URILE (Gmelin) Red-faced Cormorant

Hitherto this cormorant has been known from St. Lawrence Island only on the basis of Nelson's statement that it is a, " . . . more or less common summer resident" there. No specimens have been taken in the flesh as far as I know. However, bones attributable to this species are included in the results of 8 diggings, but only in cuttings of ancient sites. It may well be that the species was formerly more abundant on St. Lawrence Island that it is today, but no reasons can be advanced to account for its change in status. The most ancient site, the Hillside Village revealed a fragment of a humerus; Ievoghiyogameet yielded the greatest number of bones distributed among 4 cuttings, one of which contained as many as 12 tarsometatarsi and 3 tibiotarsi; while 3 cuttings at Kialegak produced 2 humeri and 1 tarsometatarsus. The fact that the species is represented at both ends of the island (Gambell and Kialegak) indicates that it was widespread in its local range. If it were present in only one place, it might have been assumed that its hypothecated decrease might have been due to the decimation of the sole colony on the island.

Family ANATIDAE Ducks, Geese, Swans

CYGNUS COLUMBIANUS (Ord) Whistling Swan

When one considers the gastronomic desirability of this, the largest edible bird on the island, and its fairly even distribution there, it is surprising that its remains have been found only in the deposits at Kialegak and not in any of the old sites near Gambell. At Kialegak it is represented by a pair of clavicles and several fragmentary bones found in 3 separate diggings.

BRANTA CANADENSIS MINIMA Ridgway Cackling Goose

The cackling goose is an addition to the known avifauna of St. Lawrence Island. It is represented in 2 cuttings of the upper layer of the Kialegak site; in one by a coracoid, in the other by a pair of clavicles.

BRANTA NIGRICANS (Lawrence) Black Brant

This goose is also new to the known bird fauna of the island. It is represented by a metacarpal found in a basal digging at Kialegak.

PHILACTE CANAGICA (Sevastianoff) Emperor Goose

The remains of the emperor goose are remarkably few in number considering the abundance of the bird on St. Lawrence Island, and the extent to which it is hunted and used for food by the Eskimos. Furthermore, its bones are present in neither the two oldest sites (Hillside Village and Miyowaghameet) nor the most recent one (Gambell), but chiefly in the diggings at Kialegak, and, in small numbers, in 2 cuttings at Seklowaghyaget. At Kialegak bones of the emperor goose were found in 5 cuttings; at Seklowaghyaget in 2 diggings. Strangely enough, almost no long bones were unearthed, but chiefly metacarpals and fragments of clavicles and coracoids.

The fact that the majority of the bones come from Kialegak at the southeast end of the island is in keeping with the present distribution of the bird. It is found chiefly in the southern part of the island, especially in the vicinity of the long lake and lagoons. On the north side the species is not nearly so common.

ANSER ALBIFRONS ALBIFRONS (Scopoli) White-fronted Goose

The white-fronted goose is represented in the remains from Kialegak (2 diggings) and Ievoghiyogameet (1 cutting), in all cases by metacarpals only. It is peculiar, to say the least, that all four species

of geese are represented by bones other than the long limb bones usually preserved, such as the humerus, femur and tibiotarsus.

Apparently the white-fronted goose has always been an uncommon bird in St. Lawrence Island, as it is today.

DAFILA ACUTA TZITZIHOA (Vieillot) American Pintail

The pintail is represented by a single bone, a tarsometatarsus found at Kialegak.

NYROCA MARILA (Linnaeus) Greater Scaup Duck

One sternum, collected at Ievoghiyogameet, is referable to this duck. Previously the greater scaup duck was known from St. Lawrence Island only on the basis of Nelson's statement of its occurrence there. No specimens were collected by him.

CLANGULA HYEMALIS (Linnaeus) Old-squaw

The old squaw is one of the commonest ducks on the island, and its bones have been found in 12 diggings, the greatest number being at Kialegak, where it is represented in 7 cuttings. The oldest bones come from Miyowaghameet (3 diggings); one fragmentary skull was found at Ievoghiyogameet, and a piece of a sternum was unearthed in the recent village site at Gambell.

HISTRIONICUS HISTRIONICUS PACIFICUS Brooks

Western Harlequin Duck

The western harlequin duck is represented by bones chiefly in the Kialegak and Ievoghiyogameet sites. In the former it was found in 4 diggings; in the latter village, in 2 cuttings. A single coracoid comes from the excavations at Seklowaghyaget as well. The Kialegak and Ievoghiyogameet specimens are all humeri except for a pair of tarsometatarsi.

POLYSTICTA STELLERI (Pallas) Steller's Eider

Steller's eider appears among the remains of the oldest site, the Hillside Village, in the form of a fragmentary femur. Otherwise it is represented only from Kialegak, where, however, it figures in four diggings, 3 of which yielded a humerus apiece and 1 a synsacrum.

SOMATERIA V-NIGRA Gray Pacific Eider

The Pacific eider is abundantly represented in the present collection, its bones being recorded from 32 separate cuttings, ranging

throughout all the sites and ages except the very oldest (Hillside Village), and Seklowaghyaget. At Miyowaghameet, it was found in 3 cuttings; at Ievoghiyogameet, in 7 cuttings; at Kialegak, in 20 diggings; at the recent Gambell site, in 2 diggings.

SOMATERIA SPECTABILIS (Linnaeus) King Eider

Today the Pacific eider is much more abundant on St. Lawrence Island than the king eider, but, if we may judge by the skeletal remains, the latter species was somewhat the commoner of the two in the pre-historic past, or else was often selected as an object of the chase by the Eskimos. Remains of the king eider are included in the material excavated at 37 different diggings. The oldest village site revealed a coracoid of this duck, and its bones have been found at each of the other village deposits except, strangely enough, the recent village site at Gambell. At Miyowaghameet it was found in 1 cutting; at Ievoghiyogameet in 3 cuttings; at Kialegak, where it was found in greatest numbers, in 31 diggings; at Seklowaghyaget in 1 digging. The absence of this species from the recent Gambell site is of interest in connection with its relative decrease in abundance at present.

ARCTONETTA FISCHERI (Brandt) Spectacled Eider

The spectacled eider is represented only in the collections from Kialegak, where it was found in 4 cuttings. All in all, 3 humeri and 4 coracoids were unearthed.

MELANITTA DEGLANDI (Bonaparte) White-winged Scoter

The discovery that this duck was represented in no less than 9 diggings at Kialegak is very surprising in view of the fact that the species had never been recorded from the island before. To find a bird new to the local avifauna in a single cutting is a thing to be expected, but to find such abundant evidence of one is really unusual. It is significant that the species was found only from the southeast end of St. Lawrence Island, the point nearest its mainland range. The bones include 2 tarsometatarsi, 2 tibiotarsi, 1 coracoid, and many fragmentary pieces.

MELANITTA PERSPICILLATA (Linnaeus) Surf Scoter

A humerus, found at Kialegak, is of this species. The surf scoter is new to the avifauna of St. Lawrence Island. As far as I know, this is the most northwestern locality whence the species has been recorded as yet.

OIDEMIA AMERICANA Swainson American Scoter

The American scoter seems (from somewhat inconclusive evidence) to have been commoner on St. Lawrence Island in the past than it is today. Bones of this duck are present in the collections made in 5 different diggings at Kialegak. Of naturalists who have made observations on the bird life of the island, only Nelson has recorded this species, and he reported it as occurring only sparingly there. None of the collectors since the time of Nelson's visit have found it.

The fact that no bones of this duck were found at any of the sites at the northwest end of island suggests that even in the past (perhaps 1000 years ago) its range on the island was very limited. This may still be so, and may be the reason recent visitors have failed to find it.

MERGUS MERGANSER subsp. indet. Merganser

A number of bones, from 5 different diggings at Kialegak, are definitely referable to this species, but I cannot find any diagnostic skeletal characters by which to determine their subspecific identity. Neither race of the merganser has ever been found near St. Lawrence Island and either one might be the form involved as the island is just about half way between the known limits of their respective ranges. If the bird should turn out to be the nominate Eurasian form, it would be an addition to the North American avifauna, if it should be *M. m. americanus*, it would be a considerable extension of range. The species is new to St. Lawrence Island.

The bones include 1 humerus, 1 radius, 2 ulnae, 7 metacarpals, and 1 tibiotarsus.

MERGUS SERRATOR Linnaeus Red-breasted Merganser

The red-breasted merganser is represented by a tibiotarsus and a metacarpal, both from Kialegak (2 separate diggings).

Family GRUIDAE Cranes

GRUS CANADENSIS CANADENSIS (Linnaeus) Little Brown Crane

Three village sites (Miyowaghameet, Ievoghiyogameet, and Kialegak) yielded bones of this crane. Most of the bones are fragmentary but a whole tarsometatarsus was found at Ievoghiyogameet. In a bird of this size the absence of records from a deposit is fairly good evidence that the species was either not present or was not fed upon by the Eskimos.

Family SCOLOPACIDAE Woodcock, Snipe, and Sandpipers

HETEROSCELUS INCANUS (Gmelin) Wandering Tattler

A humerus found in one of the basal diggings at Kialegak appears to be of this species. St. Lawrence Island is the northwesternmost locality from which this bird has been recorded so far. The wandering tattler is an addition to the avifauna of the island.

Family STERCORARIIDAE Jaegers and Skuas

STERCORARIUS POMARINUS (Temminck) Pomarine Jaeger

The pomarine jaeger is represented only in the material excavated at Kialegak, where its bones were found in 4 separate diggings.

STERCORARIUS PARASITICUS (Linnaeus) Parasitic Jaeger

The three oldest village sites (Hillside Village, Miyowaghameet, and Kialegak) yielded osseous remnants of the parasitic jaeger, but the more recent sites did not. Only a few bones were found in all—3 humeri, 3 tibiotarsi, 1 ulna, and several fragments.

STERCORARIUS LONGICAUDUS Vieillot Long-tailed Jaeger

The abundance of bones of this jaeger came as a distinct surprise as the species was not previously recorded as particularly common on St. Lawrence Island. Bones attributable to it were found in twenty-six diggings, from the oldest site (Hillside Village) to the newest (the recent Gambell site). In the Hillside Village site a fragmentary humerus and a tarsometatarsus were found; at Miyowaghameet (4 cuttings) 7 humeri, 4 tarsometatarsi, and 3 tibiotarsi were found; at Kialegak bones were found in 15 separate cuttings, the bones including 7 humeri, 1 coracoid, 6 tarsometatarsi, 2 femurs, and fragments; at Ievoghiyogameet (5 diggings) 8 humeri, and 4 tarsometatarsi were collected; at Gambell (recent) 2 tarsometatarsi were unearthed.

This bird is said to walk about on the ground when feeding on insects, and it is probably at such times that the Eskimos are able to kill it in numbers.

Family LARIDAE Gulls, Terns

LARUS HYPERBOREUS Gunnerusm Glaucous Gull

The ancient Hillside Village yielded a fragmentary humerus and a piece of a mandible of this gull; a coracoid was found at Miyowaghameet; 2 cuttings at Ievoghiyogameet produced 1 skull, 1 extra max-

illa, 1 tarsometatarsus, and 1 coracoid; the Kialegak collection contained a pair of mandibles.

LARUS GLAUCESCENS Naumann Glaucous-winged Gull

This gull is more abundantly represented in the collection than the preceding species. It was found in 7 diggings at Miyowaghameet, Ievoghiyogameet, Kialegak, and the recent site at Gambell. The remains include 4 metacarpals, 1 fragmentary skull, 1 pair of mandibles, 1 sternum, 1 ulna, and fragments.

LARUS BRACHYRHYNCHUS Richardson Short-billed Gull

This gull was not mentioned in my list of the birds of St. Lawrence Island (Proc. U. S. Nat. Mus. **80**, art. 12. 1932), but I have since found that Bent (Bull. U. S. Nat. Mus. **113**: 145. 1921.) states that it breeds on the island. Furthermore, the map in Cooke's paper on the distribution of North American gulls (U. S. Dept. Agric. Bull. **292**: 47. 1915.) shows a record for St. Lawrence Island. Bones of this gull were found in 3 diggings, all at Ievoghiyogameet. The bones include 3 ulnae and a sternum.

RISSA TRIDACTYLA POLLICARIS Ridgway Pacific Kittiwake

This gull is represented in 11 diggings in the old village sites (Hillside Village, Miyowaghameet, Kialegak, and Ievoghiyogameet) and seems to have been as numerous 1000 or more years ago as it is today. A broken pair of mandibles found at Hillside Village and an ulna from Miyowaghameet are the oldest specimens in the order named. Kialegak site contained many bones, as 4 cuttings there revealed this species; but the greatest abundance of kittiwake bones was found at Ievoghiyogameet, where 5 cuttings yielded 1 sternum, 1 pair of mandibles, 1 skull, 6 ulnae, 1 humerus, and 1 metacarpal.

RISSA BREVIROSTRIS (Bruch) Red-legged Kittiwake

This gull is an addition to the avifauna of St. Lawrence Island. It is represented by a pair of mandibles found in a superficial digging at Ievoghiyogameet. This constitutes a considerable northward extension of the known range of the species.

Family ALCIDAE Auks, Murres, Auklets

URIA LOMVIA ARRA (Pallas) Pallas's Murre

This, the most abundant bird on St. Lawrence Island today, is also by an enormous percentage, the species most abundantly represented

by the bones from the old village sites. It is represented in 69 diggings, from all the sites and of all the ages. It is also represented by almost as many individual bones as all the other species combined. Two humeri, collected at Kialegak, match exactly humeri of *Uria aalge californica*, but I am not convinced that it is advisable to attempt to separate the two murres on the basis of their humeri as they are so very similar and overlap in their dimensions.

It is obvious that Pallas's murre is the most important avian item of food in the lives of the St. Lawrence Eskimos.

CEPPHUS COLUMBA Pallas Pigeon Guillemot

This guillemot is represented by bones from 16 diggings from all the village sites except Seklowaghyaget. Apparently its numerical status on St. Lawrence Island has not changed much during the last 2500 or so years.

BRACHYRHAMPHUS BREVIROSTRIS (Vigors) Kittlitz's Murrelet

A humerus from a basal digging at Ievoghiyogameet is the only record of this murrelet for St. Lawrence Island. Although it is known to breed on both the Alaskan and Siberian coasts of Bering Sea and adjacent parts of the Arctic Ocean, it had not been reported from St. Lawrence Island before.

CYCLORRHYNCHUS PSITTACULA (Pallas) Paroquet Auklet

The paroquet auklet is abundantly represented in the diggings of all the village sites except the very old Hillside Village. The greatest quantity of bones came from Kialegak in the southeastern part of the island; fewer from the Gambell region at the northwestern tip. This is in keeping with present local distribution of this bird on St. Lawrence Island.

AETHIA CRISTATELLA (Pallas) Crested Auklet

The crested auklet, one of the common birds of St. Lawrence Island, is represented in 16 diggings, all from the sites at the northwest end of the island, and not at all from Kialegak at the opposite end, where it is replaced by the paroquet auklet, just as the two species complement each other's local range today. The old Hillside Village yielded 4 humeri; Miyowaghameet (4 cuttings) many bones; Ievoghiyogameet (6 cuttings) yielded still more, as many as 20 humeri, and 1 sternum being found in one digging alone; Seklowaghyaget (2 cuttings) produced several bones; and the recent Gambell site (2 dig-

gings) revealed many more, as many as 11 humeri and 3 sterna in one digging.

AETHIA PUSILLA (Pallas) Least Auklet

The least auklet is represented in 3 diggings from 3 villages at Gambell (Miyowaghameet, Ievoghiyogameet, and the recent Gambell site). Only a few bones were found in all, the total being 4 humeri and 1 sternum.

FRATERCULA CORNICULATA (Naumann) Horned Puffin

In spite of their abundance and size neither of the puffins inhabiting St. Lawrence Island seems to have figured very largely in the diet of the ancient Eskimos. Remains of the present species were found in 8 diggings representing the following sites: Miyowaghameet, Kialegak, and Ievoghiyogameet. Most of the bones were found singly; in 2 diggings more than 1 bone was found (2 in one case, 3 in the other).

LUNDA CIRRHATA (Pallas) Tufted Puffin

This puffin is more numerously represented than the horned species. It figures in 14 diggings from both ends of the island (Gambell and Kialegak). The specimens come from ends of the chronological series of excavations—from Hillside Village, Miyowaghameet, Ievoghiyogameet, Kialegak, as well as from the recent Gambell site.

Family STRIGIDAE Owls

NYCTEA NYCTEA (Linnaeus) Snowy Owl

The snowy owl is represented by a pair of metacarpals and by a few fragments, both from cuttings at Kialegak. The absence of bones of this species from the other sites and from the other diggings at Kialegak may mean that owls are not looked upon as a food supply as long as other birds are available.

ETHNOLOGY.—*Newly discovered Powhatan bird names.*[1] JOHN R. SWANTON, Bureau of American Ethnology.

Dr. Alexander Wetmore, assistant secretary of the Smithsonian Institution, has called my attention to an article in *The Auk* for July, 1933 which contains a number of bird names in Indian not apparently recorded elsewhere. The article is entitled *Topsell's 'Fowles of heauen'* and was read by its author, Bayard H. Christy, at the fiftieth meeting of the American Ornithologists' Union, Quebec, October 18, 1932.

[1] Received October 30, 1933.

Edward Topsell, it seems, who died about 1638, was "an English clergyman, and sometime curate of St. Botolph, Aldersgate," chiefly remembered as the author of a *Historie of four-footed beastes* and a *Historie of serpents*, which were printed in 1607 and 1608 respectively. "It now appears," says Christy, "that, having projected a third work on *The fowles of heauen*, he progressed with it so far as to complete a first part—perhaps one fifth of the contemplated whole. The dedication is to Baron Ellesmere, the Lord Chancellor; to him, as may be supposed, the MS. was transmitted; and from a descendant of his the Huntington Library acquired it. Resting today in the archives of that library, it forms part of the Ellesmere Collection, and bears the identifying number, E L 1142." From internal evidence it appears that it was written "before the end of the year 1614, and perhaps a year or two earlier than that."

Among the birds illustrated are nine from Virginia, eight of which, all but *The Crane of Virginia*, are accompanied by their Indian names which Christy gives and attempts to identify as follows:

"The *Aushouetta* (= the Thrasher?)
The *Aupseo* (= the Bluebird)
The *Aiussaco* (= the Flicker)
The *Artamokes* (= the Blue Jay)
The *Chuguareo* (= the Red-winged Blackbird)
The *Chuwheeo* (= the Towhee)
The *Chowankus* (= the female Towhee?)
The *Tarawkow Konekautes* (= the Sandhill Crane)

"A *Black-macke of Brasilia* is also figured which manifestly is a tanager."

At the end of the volume is a prospectus indicating the birds which were to be treated in subsequent parts, and among these are eight more Virginia birds, all but one of which, the *Turkey Cocke*, have their Indian designations. These are the "*Kaiuk, Manasscneau, Meessenouns, Pockway, Poocgueo, Poppogattuweo*, and *Teauh*."

While the term "Virginia" had a somewhat extended use in Topsell's time, its appearance and the date of compilation of the manuscript show conclusively that we must look to the Powhatan language for the origin of the names. This is important because it means the addition of fourteen or fifteen words to our scanty material from this Algonquian dialect. Not being a student of Algonquian myself, I have submitted these words to two fellow members of the Bureau of Ethnology, Mr. J. N. B. Hewitt and Dr. Truman Michelson, to

Prof. Frank G. Speck of the University of Pennsylvania, and Prof. John M. Cooper of the Catholic University of America, who have kindly furnished the following notes:

Aushouetta. Attention might be called to a bird called *ahshowcutters*, mentioned by Strachey, which had "carnation-coloured wings." Speck says this is perhaps the red-start, the term being derived from the word for "fire" (cf. Penobscot *skunt·e's*, "little fire," or "little flame"), from its red flashing wings and tail, pointing out that in Cuba it is known as the *candelita* for the same reason. Commenting on this, Cooper states that the Tête-de-Boule Cree word for "fire" is *ickwudē.*[2]

Aupseo. Speck points out that this name is evidently identical with Oklahoma Delaware *a'psi·o* which signifies "he is white," white and light blue being covered by the same term.

Aiussaco. The Tête-de-Boule Cree term obtained for this bird by Cooper *wurȧkōnē'o*, is evidently unrelated, but that for crow, *āyā'sio* is rather close. The common Cree word for raven, and often for crow, he gives, however, as *kā'kāgō.*

Artamokes. None of the informants could suggest a parallel.

Chuguareo. Hewitt gives the following names for this bird: *chógan* in Narragansett (Williams), *tsougheres* in Abnaki (Rasle), *chog-luskw* in modern Abnaki (K.A.), *tschoquali* or *tschukqualli* in Delaware (Zeisberger), *tskennak* in modern Delaware (Anthony), *assiggenauk* (*siggenauk*) (Tanner), *auchugyeze* in Pequot (Stiles). Speck gives the Penobscot word as *tcugwala'so* and states that it is derived from the bird's call as are also the Delaware terms. Cooper says that the Tête-de-Boule Cree name is *mi'kwo tcatca'k*ᵛ*ero*, in which *mi'kwo* signifies "blood," and *tcatcak* is onomatopoetic. "The Tête-de-Boule children, when they hear or see a redwinged blackbird, imitate its call by a half-chanted articulated verbalization, as follows: *tcȧk' tcȧk' tcȧk' tcȧkᵃ-lȧwē'*, the last *ē* being very long."

Chuwheeo. Cooper reports having once recorded the Tête-de-Boule Cree word for this bird as *pastē'cīc*, but feels none too sure of it and in any case there is evidently no relationship.

Chowankus. No suggestion was ventured. The form of this word is rather similar to Strachey's *cheawanta*, "a robin red-breast," but that may be merely accidental.

[2] In the notes furnished by Dr. Cooper, c is equivalent to English sh; ȧ to English u in but; ' indicates a glottal stop; and ᵛ is a voiceless or barely audible sound. Prof. Speck has the following special signs: i· a closed vowel like ee in queen; n· and t· lengthened consonants equivalent to nn and tt; ɑ an obscure vowel like e in English her; ʿ an aspiration following a vowel or consonant.

Tarawkow Konekautes. Hewitt gives the following synonyms: *tare'gañ* (pl. *tare'gok*) in Abnaki (Rasle), *taroecka* in the Algonquian dialect of New Sweden, *tale'ka* in Delaware (Zeisberger), *taûnek* in Narragansett (Williams). He thinks "konekautes" signifies "long legged," and is supported by Speck who gives the Delaware form of the word as *kwun·i·ka't.*

Kaiuk. Hewitt gives *kaa'kow* or *kaiakou* in Abnaki (Rasle), and points out that the same word is given by Strachey in the form *coiahqwus.* Cooper states that the Tête-de-Boule Cree term for the American herring gull is *kio'k*^{wa}, and that the Albany Cree on James Bay call this bird *kīack,* the common tern being *kīa'ck*^{w}*ōcīc.*

Manasscneau. Cooper gives *uki'skimanisē'o,* kingfisher, the Tête-de-Boule Cree term, as involving a possible explanation.

Meessenouns. Michelson says that this word seems to signify "little big-partridge," perhaps indicating a small specimen of some bird known as "big-partridge." Dr. Wetmore suggests that it was probably the quail.

Pockaway and *Poocgueo.* Michelson thinks that one, and perhaps both, of these names were intended for the pheasant. Cooper suggests, rather doubtfully, that *pockaway* may be related to Tête-de-Boule Cree *pīck,* "night-hawk," and cites *pĕpŭckē'o* (given by another informant as *pàpàskio*) as the name of the ruffed grouse in the same language. Dr. Wetmore thinks that the bird intended by these two names was the ruffed grouse, or possibly the prairie chicken.

Poppogattuweo. According to Michelson this word seems to indicate some bird making a noise as it alights. Speck says it may possibly refer to the quail, the Mohegan-Pequot word for which would be *bopu'kwati·s,* "the spotted or speckled little (bird)." Cooper mentions as a possible analogy Tête-de-Boule Cree *papastē'o,* the name of one of the woodpeckers.

ARCHEOLOGY.—*A variety of Caddo pottery from Louisiana.*[1] W. M. WALKER, Bureau of American Ethnology. (Communicated by JOHN R. SWANTON.)

The accidental discovery of an ancient burial ground near the town of Natchitoches, La. during the summer of 1931, reported by the writer in the Smithsonian Explorations volume for that year, has made possible the identification of the type of pottery made by the Natchi-

[1] Published by permission of the Secretary of the Smithsonian Institution. Received December 8, 1933.

toches, one of the constituent members of the Caddo confederacy. This identification rests not alone on the finding of European trade objects in immediate association with the Indian artifacts but is further strengthened by documentary evidence tending to show that the site stands on or near the village of the Natchitoches first visited by Henri de Tonti in 1690. As the detailed proof of this assertion has

Fig. 1—Polished and engraved bowl, black with red filled lines. Typical Natchitoches pottery. ×½.

been offered in the complete report already submitted to the Bureau, no attempt will be made to repeat it, even at the risk of appearing dogmatic.

The principal significance of this discovery is that it establishes not only the pottery type of this particular tribe but also shows it to be practically identical with that of a closely allied tribe, the Ouachita. Thus we have a key which it is hoped will help unlock the major problem confronting the archeologist in the Red River region—the ancient remains attributable to the Caddo tribes. The published reports of such workers as Moore,[2] Harrington,[3] and Pearce,[4] with their

[2] Moore, C. B. *Antiquities of the Ouachita Valley.* Jour. of the Acad. Nat. Sci. Phila. 14: 1. 1909.

[3] Harrington, M. R. *Certain Caddo sites in Arkansas.* Indian notes and monographs, Mus. Amer. Ind. Heye Foundation. N. Y. 1920.

[4] Pearce, J. E. *The archaeology of east Texas.* Amer. Anthrop. 34: 4. 1932.

many excellent illustrations, have laid the ground work for detailed comparative studies which will be rendered easier after further determination of the other archeological components of historic Caddo cul-

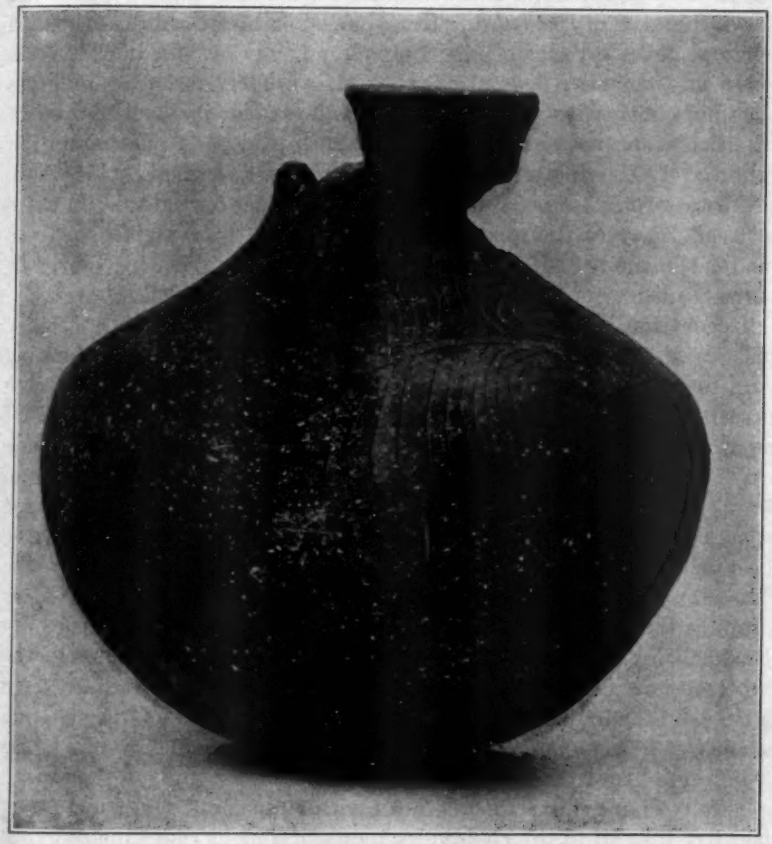

Fig. 2.—Bottle fragment, Natchitoches type, incised but not polished. ×½.

ture, such as those furnished by the Adai, Yatasi, Petit Caddo, and Grand Caddo.

Unfortunately of the pottery vessels found at the Cane River site near Natchitoches practically none were recovered intact, but enough fragments were obtained to give a good idea of the nature of the ware and its decoration. In form they range from conical bowls, cup-like bowls with flaring collars, small jugs and pots, to subglobular bottles

with short necks. The quality of the ware also varies from coarse, crude, undecorated poorly fired pieces to highly polished, engraved specimens rubbed with ochraeous coloring matter—the typical Red River Ware of Moore and Harrington. The bowl fragment seen in fig. 1 is of this latter type, bearing traces of red paint only in the engraved portions of the collar, while its companion from the same burial, fig. 2, bears only an incised decoration much more crudely executed and lacks the final polish of the bowl. All of the ware is heavily shell-tempered, whether decorated or not. This is in sharp contrast to the condition reported by Harrington for the Caddo pottery described by him from southwestern Arkansas, but may perhaps be due to greater abundance or availability of the mussel-shell material at the Natchitoches site nearer the mouth of Red River. The paste is grayish in color, but turns reddish after firing.

Decoration of the Natchitoches pottery was produced apparently only by the incising and engraving techniques, as no sherds bearing cord markings, punctate, stamped, ridged, or rouletted designs were present, nor was there any use of paint other than in the color-filled engravings already noted. The designs most typically found are made up of combinations of parallel straight and curved lines, interlocked scroll meanders, and rounded spots, with reticulated or hachured spaces intervening. Decoration applied after drying and firing may be best described as incised, that completed after polishing, as engraved. The shiny black polish on the bowl may have been achieved after dipping the vessel in bears' oil after firing, a process recorded by Bushnell for the Choctaw.[5] Elements most commonly found in the bowl designs comprise four spiral arms appearing to radiate from a circle on the under side of the vessel which is always left as a cleared space free from any decoration. In the case of the small cup-like bowls a different band of design forms the encircling collar of the vessel, generally employing a zig-zag motif with large spots. One bowl found had five instead of the customary four spiral arms radiating outward from the central circular area on the bottom over the body of the vessel.

Small pipe bowls not over two inches high were also manufactured out of the same kind of shell-tempered clay (Fig. 3). They are in the form of a cone set into a cup-shaped base and lack an attached stem, thus differing completely from the forms found by both Moore and Harrington farther up Red River.

[5] BUSHNELL, D. I. JR. *The Choctaw of Bayou Lacomb, Louisiana*. Bur. Amer. Ethnol. Bull. 48: 12. 1909

The closest resemblance to the Natchitoches pottery is that found by Moore on the Ouachita river at Glendora Plantation and Keno Place. Both in shape and decoration these vessels are almost duplicates of those found at Natchitoches, the explanation of which is that the Ouachita and Natchitoches were found living together at the site visited by Tonti on Red River, and the trading path between the distant settlements of the two tribes is clearly shown on La Fon's map of Louisiana as late as 1806. Which tribe is to be regarded as the originator of this ceramic style is not certain from the data at hand.

Fig. 3.—Natchitoches pottery pipe bowl. Note possible property mark scratched on front. ×1.

The northernmost limit of distribution of this kind of pottery seems to be along the Arkansas river in the vicinity of Pine Bluff, Arkansas. Moore found at the Douglas site and at the site near Greer unmistakable specimens of Natchitoches-Ouachita ware and it was present also at the Battle Place site on Red River. More recently Pearce has described and figured the same kind of pottery from farther west in the Red River section of East Texas[6] which may also be Natchitoches in origin as the early historians note an upper and a lower village of this tribe some 100 leagues apart on Red River. It is important to note, however, that this ware differs somewhat from that found by Harrington in southwest Arkansas and regarded by him as of Caddo manufacture. Although the technique of decoration

[6] PEARCE op. cit. Plate 23 a.b.

is much the same there are stylistic differences that are quite noticeable. The scroll, for instance, is not so prevalent a motif as in the Natchitoches ware. The characteristic vessel forms of the latter are also absent, though there is present a greater variety of shapes. This is not to be taken as an indication that Harrington's pottery may not also be Caddo, but only that it does not conform to the ceramic pattern here identified as belonging to the Natchitoches-Ouachita division of the Caddo confederacy. When the village site of the Kadohadacho or Grand Caddo somewhere in the great bend region of Red River, can be located definitely and its archeological remains studied we may be in a position to see the relationship of these two types of pottery more clearly.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

1056TH MEETING

The 1056th meeting was held in the Cosmos Club Auditorium, May 20th, 1933, President O. S. ADAMS presiding.

Program: J. G. THOMPSON: *The use of physical methods for testing purity of metals.*—Some of the common metals such as aluminum and zinc have been produced recently in extremely pure forms, approaching absolute purity. The new and improved properties of these superpure metals have convinced metallurgists that amounts of impurities formerly considered to be unavoidable and not objectionable can no longer be so regarded; a few thousandths of one per cent are no longer negligible.

The Bureau of Standards is attempting to prepare iron as pure as possible in order that the basic properties of this fundamentally important metal may be determined. A state of purity has been attained such that the exact determination of the purity and of minor changes in the purity, in subsequent operations, has become a real problem. Chemical analysis is limited in its usefulness. The possible use of various physical methods has been considered, including spectrochemical analysis, the determination of thermal emf, permeability, and critical temperatures but it appears that none of these determinations yield the desired information. The most promising method for the determination of purity in high purity iron appears to be the determination of the temperature coefficient of resistivity but further information concerning the effect of details such as annealing treatment is needed. (*Author's abstract.*)

Discussed by Messrs. P. W. WHITE, ROESER, HAWKESWORTH, RAMBERG, HUMPHREYS, TUCKERMAN, KRACEK, and RAWDON.

LOUIS JORDAN and H. S. RAWDON: *The preparation of metal single crystals and their utilization in metallurgical studies.*—The properties of metal single crystals are obviously the fundamental properties of the polycrystalline metals which are in very day use in scientific and engineering applications. These fundamental properties are modified in polycrystalline metals by the

effects of different crystal lattice orientations in adjacent grains and of grain boundary effects. It is logical to study such modifying effects by the preparation and examination of single crystal and bi-crystal metal specimens. One of the major problems of present day physical metallurgy is the study of the so-called "creep" of metals, that is, the slow and sometimes continuous plastic deformation of metals which are subjected to prolonged loading at temperatures which are relatively high as compared with the melting point of the metal in question. Creep tests of single crystal and bi-crystal metal specimens are promising much in this field of metallurgical study.

Metal single crystals may be quite readily formed either from the solid, the liquid, or the gaseous phase of a metal by several methods: (1) by straining and annealing a solid bar or strip of the metal; (2) by growing a metal "icicle" or "stalactite" by slowly raising a metal rod from the surface of a mass of liquid metal; (3) by slow deposition on a wire of atoms from metal vapor; (4) by lowering a crucible of liquid metal through a furnace; (5) by slowly cooling a stationary crucible of liquid metal so arranged that all cooling proceeds from one point on the crucible.

Metal single crystals exhibit several peculiarities in both physical and chemical properties. Indentations made on single crystals by conical or spherical indenting points produce patterns characteristic of the crystal lattice of the metal (square or hexagonal). Single crystal bars broken in tension deform to ribbon-like cross-section and break with a chisel-edge fracture instead of the familiar conical fractures of polycrystalline bars.

The chemical activity of different planes of atoms in the metal crystal lattice varies to such a degree that it is possible, by a suitable selection of etching reagents, to develop on the surface of single crystal specimens etched patterns characteristic of several simple lattice planes, e.g., the cubic, octahedral, or dodecahedral faces of the cubic lattice of copper. This furnishes a simple visual method of determining the crystal orientation in single crystal test specimens. (*Authors' abstract.*)

Discussed by Messrs. HAWKESWORTH, HUMPHREYS, H. L. CURTIS, and BRICKWEDDE.

1057TH MEETING

The 1057th meeting was held in the Cosmos Club Auditorium, October 14th, 1933, President O. S. ADAMS presiding.

Program: HARRY DIAMOND: *Recent developments in radio aids to air navigation.*—The paper discussed recent developments in directional guidance of aircraft by radio. Point to point guidance along the civil airways of the United States is provided by a network of radio range-beacons. Means have been developed for furnishing either aural, visual or combined aural and visual indication of the position of the airplane with respect to the beacon courses. A single transmitter and antenna system for simultaneous transmission of phone weather broadcasts and the beacon signals has also been developed. A recent major improvement in the beacon network is the replacement of the loop transmitting antennas by a new type of antenna system, called the TL antenna. The latter was developed to eliminate irregular and erratic course variations occurring at night.

A system of radio landing aids permitting safe landing of airplanes under zero conditions of ceiling and visibility was also described. The system comprises three elements; a low power radio range-beacon for giving guidance to the landing airplane along the proper approach to the airport, an ultra-high frequency landing beam for giving vertical guidance and marker beacons for

indicating the longitudinal position of the airplane. On the airplane a single crossed-pointer type instrument combines the indications from the first two elements, while the marker beacon signals are heard in the headphones. Successful tests of the system at College Park, Md. and Newark, N. J. were described and a movie reel of a completely blind landing was shown. (*Author's abstract.*)

Discussed by Messrs. HAWKESWORTH and WATSON DAVIS.

W. B. BURGESS: *Application of radio direction finding.*—After a brief history of the investigations of atmospheric disturbances, means were discussed for directional studies. It was shown that the cathode ray type of direction finder, first developed by R. A. Watson-Watt, has proven most practicable. Improvements in this type were traced from the first model, using twelve hundred foot loops, to one recently developed by the U. S. Navy, of unit construction, employing loops less than three feet square, but of high sensitivity.

This model gives instantaneous unilateral indications of direction and field strength on individual impulses. Two of these instruments are being used in a study of atmospherics due to tropical hurricanes. It is believed that their use will lead to an increase in the available data on such storms, and that losses due to them may be minimized by advance information of the storm path, as determined by the radio direction finder. (*Author's abstract.*)

Discussed by Mr. SEARLES.

The following informal communications were presented.

P. R. HEYL.—In 1863, Hermite proved that the number e, base of the natural system of logarithms, is transcendental. Lindemann in 1872 made use of this theorem to prove that e^z, where z is a rational number, is also transcendental. From this, Lindemann wrote, it follows that π is transcendental. The intermediate steps are not obvious. (*Secretary's abstract*).

Discussed by Messrs. HAWKESWORTH and NAIMAN.

P. R. HEYL.—The number π expanded to 708 terms contains the different digits as follows:

Digit	*Number of Occurrences*
0	75
1	76
2	74
3	73
4	71
5	64
6	70
7	54
8	72
9	79

(*Secretary's abstract.*)

Discussed by Messrs. DRYDEN and GOLDBERG.

RAYMOND J. SEEGER.—The magnetic moment of the proton was determined by sending beams of ortho- and para-hydrogen through a nonhomogeneous magnetic field after the manner of the earlier experiments of Gerlach and Stern.

Fermi made a calculation of the magnetic moment of the hydrogen molecule. The largest contribution to the magnetic moment of a hydrogen molecule comes from the rotation of the protons around the center of mass of the

molecule. The electron spins of the two electrons cancel each other vectorially, and because the electrons rotate more slowly around the center of mass than the protons, acting as though they were being dragged around by the protons, the magnetic moment due to the rotation of the electrons is only about 1–4 as large as that due to the protons. In addition, there is also the magnetic moment due to the spin of the protons. In ortho-hydrogen the two protons are so directed with respect to each other that the magnetic moments due to their spins are additive, whereas, in para-hydrogen they are opposed and cancel each other as do the electron spins.

The magnetic moment of para-hydrogen is, therefore, due altogether to the rotation of the charges around the center of mass, and thus by a determination of the magnetic moment of para-hydrogen this moment can be determined. Subtracting the magnetic moment due to the rotation of the charges from the magnetic moment of ortho-hydrogen, the magnetic moment of two protons is determined.

The experimental result obtained for a single proton is between two and three times the size of a Bohr magneton for a proton ($eh/4\pi mc$, where m is the mass of the proton). (*Secretary's abstract.*)

1058TH MEETING

The 1058th meeting was held in the Cosmos Club Auditorium, October 28th, 1933, President O. S. ADAMS presiding.

Program: B. H. CARROLL: *Present theories of photographic sensitivity.*—Photographic sensitivity is measured in terms of the density developed after a given exposure and is not exclusively dependent on the extent of the photochemical change in the emulsion. Statistical studies of the sensitivity of individual silver halide grains in emulsions, combined with other chemical and physical evidence, indicate that the presence of nuclei of silver sulphide or silver are an important factor in sensitivity. Their function is apparently to increase the developability resulting from a given amount of photolysis of the silver halide, as even in the presence of the nuclei the sensitivity of a grain depends on the absorption of energy by the silver halide of that grain. (*Author's abstract.*)

Discussed by Messrs. MOHLER, HEYL, P. W. WHITE, HUMPHREYS, GISH, KRACEK, SPENCER, H. L. CURTIS and BRICKWEDDE.

R. M. REEVE: *The history of color photography including recent developments,* illustrated by lantern slides and an exhibit of color photographs.

Discussed by Mr. E. W. SPENCER.

F. G. BRICKWEDDE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

Prepared by Science Service

NOTES

Washington at the midwinter meetings.—Washington scientists attended the midwinter meetings of scientific societies in considerable numbers, and took leading parts in their programs. At the Boston meeting of the American Association for the Advancement of Science and affiliated societies, the following Washingtonians presided over the meetings of the organizations designated: R. E. SNODGRASS, Bureau of Entomology, Entomological Society

of America; C. O. APPLEMAN, University of Maryland, American Society of Plant Physiologists; C. L. SHEAR, Bureau of Plant Industry, Mycological Society of America; W. R. MAXON, U. S. National Museum, American Fern Society; W. D. LELAND, chairman of Section L (Historical and Philological Sciences) of the A.A.A.S.

An outstanding address of the meeting was delivered by the Hon. HENRY A. WALLACE, Secretary of Agriculture, who spoke before the general session on Friday evening, December 29, under the auspices of Section M (Engineering). Mr. Wallace's subject was *The social advantages and disadvantages of the engineering-scientific approach to civilization*. He pointed out that the high degree of individualism natural to most engineers had fitted in well with the highly individualized society which characterized the growing period in American history, but warned his hearers that it cannot be expected to fit into the cooperative or socialized phase which we are now entering. Particularly must the engineer give up his attitude of impersonal detachment, in which he accepted support from men who exploited his work and relieved him from any feeling of responsibility for its social consequences. Mr. WALLACE called upon his hearers to promote a broader education and a more humanistic outlook among engineers.

Among the scientific exhibits at the Boston meeting were two prepared by bureaus of the Federal government: one from the Melrose, Mass. station of the Bureau of Entomology, showing methods used in fighting the gipsy moth and other insect pests; the other from the National Bureau of Standards, showing aerodynamic tests of automobile body models, an optical strain gauge, a cement turbidimeter and a test for fatigue in airplane propellers.

During the Christmas week another group of scientific meetings were held in Philadelphia. Among the participating bodies were the Society of American Bacteriologists, at which sixteen papers were presented by Washington scientists; the American Statistical Association, the American Economic Association, the American Farm Economic Association, the Econometric Society and American Association of University Professors. At all of these meetings Washingtonians were duly represented.

The American Anthropological Association, of which Dr. JOHN MONTGOMERY COOPER of the Catholic University of America is secretary, met at Columbus, Ohio.

At the meeting of the Geological Society of America and its affiliated societies, held in Chicago, Dr. W. H. TWENHOFEL, secretary of the division of geology, National Research Council, presented two papers.

The meeting of the American Psychoanalytic Association, of which Dr. WILLIAM A. WHITE of St. Elizabeth's Hospital is vice-president, was held in Washington, December 26 and 27.

Washington was also the scene of the joint meeting of the Archaeological Institute of America, The American Philological Association and the Linguistic Society of America, Dec. 27 to 29; George Washington University acted as host institution.

At the request of the World Calendar Association, Inc., Mr. HENRY W. BEARCE, co-chief of the weights and measures division of the Bureau of Standards, attended meetings held in Philadelphia on December 28, 1933, under the auspices of the American Statistical Association, and presented a paper on calendar revision. Mr. BEARCE supported the 12-month, equal-quarters plan of revision, as opposed to the 13 equal months plan.

Bureau of Plant Industry.—Following the retirement of Dr. WILLIAM A. TAYLOR as Chief of the Bureau of Plant Industry, United States Department of Agriculture, KNOWLES A. RYERSON became Chief of the Bureau January 1, 1934. Mr. RYERSON was formerly head of the Division of Foreign Plant Introduction of the Bureau. He holds the degrees of B.S. and M.S. from the University of California.

At the same time FREDERICK D. RICHEY, formerly in charge of the Bureau's corn investigations, was appointed Associate Chief of the Bureau, to succeed Dr. KARL F. KELLERMAN, who has been placed at the head of a new Division of Plant Disease Eradication and Control in the Department. Mr. RICHEY is a graduate of the University of Missouri with the degree of B.S.A. In his new position he will give special attention to the Bureau's research activities.

Life-saving trap.—A patent on a trap attachment to safeguard small mammals and birds and to make trapping more efficient, recently granted to ALBERT M. DAY, of the Bureau of Biological Survey, has been dedicated by Mr. DAY to the free use of the public. The new device is known as the Biological Survey pan spring and is already on the market. It is a small, detachable, thin steel spring to be inserted between the pan and the base of a standard steel trap and can easily be adjusted to prevent the capture of any of the lighter animals common in a given locality. The use of the attachment also helps trappers, who lose time and effort when a trap in a carefully selected location is sprung by unsought animals or by birds.

Radio talks.—The following radio talks have been made by Washington scientists under the auspices of Science Service. They were sent out over the network of the Columbia Broadcasting System: Dr. O. E. BAKER, U. S. Department of Agriculture, *The population prospect*, December 13; J. B. KINCER, U. S. Weather Bureau, *Is our climate changing to milder?*, January 3; Dr. PAUL S. GALTSOFF, U. S. Bureau of Fisheries, *The mystery of the ocean*, January 10.

Assistant Secretary of the Interior OSCAR L. CHAPMAN of the Department of the Interior gave a radio talk January 8 over the Columbia Broadcasting System's Station WJSV in Washington. The subject of his talk was the use and value of the national parks.

Recommendations for Weather Bureau.—A committee of the Science Advisory Board, consisting of Dr. ISAIAH BOWMAN, Dr. KARL T. COMPTON, CHARLES D. REED and Dr. ROBERT A. MILLIKAN, chairman, has presented to the Secretary of Agriculture its preliminary report, recommending certain changes and measures of reorganization in the reporting and forecasting of weather in the United States. Primary recommendations are two: first, that the air-mass analysis method, already in use in certain European countries, be adopted in this country as rapidly as practicable, to supplement the method now in use here: second, that all meteorological activities now conducted by several separate agencies be integrated into one central organization, under the Weather Bureau, except for the activities necessary to the Army and the Navy. In addition to these two major recommendations, the committee also considers the following innovations desirable: a certain decentralization of the general forecast work of the Weather Bureau by the establishment of more numerous district forecast centers in place of the five now existing; an extension of climatological work, looking toward long-

range forecasting; efforts toward cooperation with other countries in the Northern Hemisphere; postgraduate training for Weather Bureau meteorologists, and the establishment of a permanent Weather Bureau Committee to advise on matters of weather service and policy.

Science in the recovery program.—Among the Federal projects approved by the Public Works Administration, five allotments indicate a recognition of the value of scientific research as part of the recovery program.

Two allotments were made to the National Planning Board. One of $35,000 provides for a program to discover, correlate, and study the researches and surveys now being made throughout the country on such subjects as natural resources, population distribution and trends, health problems, local planning, and any other field which has a direct bearing on national welfare.

A second allotment of $250,000 to the National Planning Board is to stimulate the preparation of state, regional, local and city plans by sending technical advisers out to visit the local communities.

The Bureau of Chemistry and Soils, U. S. Department of Agriculture, received $70,000 for the construction of an industrial farm by-products laboratory at Ames, Iowa, where the state agricultural college and experiment station is located.

An experimental study of stream pollution in the upper Mississippi River is provided for by an allotment of $15,000 to the U. S. Bureau of Fisheries. This Bureau also received $127,300 for the survey and improvement of streams and lakes in various sections of the country and to provide a scientific basis for such operations.

A new project of the Civil Works Administration includes the exploration of archaeological sites in five different states: Florida, Georgia, North Carolina, Tennessee and California. The work of excavation will provide employment for a total of approximately 1,000 men.

Allocation of more than $1,750,000 of funds for new construction on government property near Beltsville, Md., as a part of the Public Works program will enable the U. S. Department of Agriculture to develop there a model experiment station for agriculture.

A national experiment in land use, devoted to studying the prevention of soil erosion and providing for removal from cultivation of submarginal land instead of the average land required in the crop reduction programs, is being undertaken cooperatively by the Replacement Crops Section of the Agricultural Adjustment Administration and the Soil Erosion Service of the Department of the Interior. The experiment was authorized upon the recommendation of Secretary of Agriculture WALLACE and Secretary of Interior ICKES. It will cover two million acres of land in 10 different regions.

The Bureau of Fisheries was allotted in August by the Public Works Administration a sum of money amounting to $309,000 to be expended on some 37 projects including repairs and reconditioning to fish hatcheries, repairs to vessels, improvement to Alaska salmon streams, and the enlargement and continuation of new construction at 4 hatcheries.

NEWS BRIEFS

At the annual meeting of the Board of Trustees of the Carnegie Institution of Washington, held December 15, the following elections were announced: trustees: FRANK B. JEWETT, ROSWELL MILLER, both of New York

City; officers of the board for three ensuing years: ELIHU ROOT, chairman, HENRY S. PRITCHETT, vice-chairman, FREDERIC A. DELANO, secretary.

An aerial mapping project has been undertaken over large selected rural areas in the South, under the auspices of the Civil Works Administration.

A summary of the earthquakes of 1933 based on data compiled by seismologists of the U. S. Coast and Geodetic Survey, shows a total of about forty "earth-shakers." Of these five were destructive to property and human life, causing damage estimated at $41,000,000 and approximately 2,000 deaths.

By cooperation of several scientific agencies with the Tennessee Valley Authority, Indian mounds and other archaeological sites in areas to be excavated, flooded or otherwise disturbed will be given thorough scientific exploration with the objective of salvaging all possible data and material.

It is announced that the International Scientific Radio Union will have its Fifth General Assembly in London, September 12 to 19. This is the international organization for the promotion of radio research. Its Fourth General Assembly was held in Copenhagen in 1931. Dr. A. E. KENNELLY is the President of the Union and Chairman of its American Section. Dr. J. H. DELLINGER, Vice Chairman of the American Section, was recently appointed chairman of the Union's Commission on Radio Wave Propagation.

The International Radio Consulting Committee will have a meeting in Lisbon, beginning September 22. This is one of three advisory committees established by the international telegraph and radio conferences; the other two are on telegraphy and telephony, respectively. The International Radio Advisory Committee has had two previous meetings, The Hague, 1929 and Copenhagen, 1931.

Professor MAX BERGMAN, Director of the Kaiser Wilhelm Institute in Dresden, Germany, gave a lecture entitled *Some recent work in the chemistry of proteins and amino acids* at the George Washington University school of Medicine on Tuesday, November 28, 1933.

The December lecture on the Smith-Reed-Russell series at the School of Medicine, George Washington University, was delivered by Dr. HOWARD T. KARSNER, Department of Pathology, School of Medicine, Western Reserve University. Dr. Karsner's subject was *Rheumatic heart disease.*

More than 48,000 acres of national forest land were planted to trees this fall, the U. S. Forest Service reports. This total covers practically only a half-year, but it is greater than the acreage planted in the national forests in any preceding 12-month period. Plantings in the national forests in 1932 aggregated 24,900 acres, in 1931 they were 26,000 acres. Complete figures for 1933 are not yet available.

PERSONAL ITEMS

CHESTER C. DAVIS has been appointed administrator of the Agricultural Adjustment Act by Secretary of Agriculture WALLACE, with the approval of President ROOSEVELT.

WILLIS S. GREGG has been appointed chief of the U. S. Weather Bureau, succeeding Dr. CHARLES S. MARVIN, retired.

Dr. WALTER C. LOWDERMILK has been appointed vice-director of the Soil Erosion Service of the Department of the Interior.

Dr. H. C. DICKINSON, chief, heat and power division, National Bureau of Standards, has been appointed by Secretary of Commerce DANIEL C. ROPER, a member of the committee on uniform traffic laws and ordinances which is charged with conducting a re-survey of the standards recommended by the National Conference on Street and Highway Safety as a basis for traffic laws and ordinances in many of the states and municipalities. The committee will hold its first meeting in Washington, January 17 and 18.

Mr. J. W. GREEN, of the department of terrestrial magnetism, Carnegie Institution of Washington, returned from Toronto, Canada, December 23, 1933, where he had carried out an inter-comparison of the magnetic standards of the Carnegie Institution of Washington with those of the Meteorological Service of Canada.

Prof. GEORGE W. CARVER of Tuskegee Institute delivered a lecture at Howard University, December 14.

Miss J. BUSSE, chief, thermometry section, Bureau of Standards, was elected on January 4 to the office of Vice President of the Quota Club.

The Abbé GEORGES LEMAÎTRE, who has been visiting professor at the Catholic University of America, was designated for the award of the Mendel Medal for 1934 by Villanova College on January 12.

Dr. NEIL E. STEVENS of the Bureau of Plant Industry was elected President of the American Phytopathological Society at the mid-winter meeting of the Society at Boston.

Obituary

HOMER COLLAR SKEELS, botanist, Bureau of Plant Industry, died January 3 at East St. Louis, Illinois, where he had been spending the holidays with his daughter. Mr. SKEELS was born July 31, 1873, at Grand Rapids, Michigan, and received his elementary education in that city. He graduated from the Michigan Agricultural College in 1898 with the degree of Bachelor of Science, following which he was in charge of private parks in Joliet, Illinois, for a number of years. He came to the Bureau of Plant Industry in 1907 and served there continuously until his death. During the years spent in the Department of Agriculture, Mr. SKEELS built up a very comprehensive collection of economic seeds, now numbering nearly 45,000 samples, which work brought him a nation-wide reputation as an expert in the identification of seeds. He was a fellow of the American Association for the Advancement of Science, and in addition to the Washington Academy of Sciences was a member of the Botanical Society of America, the Botanical Society of Washington and the Biological Society of Washington.